A Note on the Concentration of Organochlorine Pesticides in Human Liver in Relation to Vitamin A Status

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Vitamin A analyses performed on 100 human livers obtained at necropsy from one Canadian city demonstrated that the vitamin was not detected in the liver of eight subjects. Thirty-two percent of the liver vitamin A values in subjects over 10 years of age were in the range of 0 to 40 ug per g (1). A second survey (2) extended the study to four additional locations. Regional differences appeared when the data was arranged according to the range of distribution of liver vitamin A and carotene stores for each city. There were more low values from Montreal (40%) than from any other location, while Vancouver had the least number (15%). The reason for differences between cities is not known and may be the result of a number of factors. A dietary survey (in progress) (3) should reveal to what extent differences in intake are responsible. As well as poor nutritional habits, it was considered that disease conditions and unknown environmental factors may contribute to the cause of the low vitamin A status in a high percentage of the subjects. It has been shown (4,5) that the dietary ingestion of DDT will reduce liver stores of vitamin A in experimental animals. It was considered of interest therefore to determine if a relationship existed between the level of vitamin A and certain organochlorine pesticides in human liver.

Methods

From the liver samples previously analyzed for vitamin A (2) 41 livers were selected as representative of individuals at various planes of vitamin A nutrition. These were selected from tissues in three distinct ranges of vitamin A, namely, non-detectable liver vitamin A stores, 80-120 ug vitamin A per g liver and liver tissue containing over 200 ug vitamin A per g. Vitamin A was determined as previously described (2). For pesticide analysis, 5 g liver were extracted twice with 125 ml acetone in a Waring blendor. The acetone extracts were combined and taken to dryness in vacuo. The residue was transferred to a separatory funnel using 25 ml of distilled water followed by 50 ml of n-hexane. Two further rinsings of the evaporation flask and extraction of the water with 50 ml of n-hexane were conducted. The hexane extracts were combined and concentrated in vacuo to about 1 ml and transferred to 50 g florisil column with 20% methylene chloride in 30-60° petroleum ether. The florisil had been dried overnight at 140° and deactivated with 5% water and the column was prewashed with 100 ml 50% methylene chloride in petroleum ether. The pesticides were eluted with 600 ml of the 20% methylene chloride in petroleum ether and the eluate was concentrated to about 1 ml, transferred to a graduated cylinder

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TABLE I

Organochlorine pesticides in human liver in relation to vitamin A status.

Vitamin A ug/g liver	No. of Subjects	Pesticide (p.p.m. liver tissue) Heptachlor epoxide	Dieldrin	p,p-DDT	p,p-DDD	p,p-DDE	Total (p,p-DDT, DDD, DDE)
non-detectable	11	.015 ± .005*	.011 ± .005	.061 ± .024	.043 ± .017	.240 ± .073	0.343 ± 0.145
80 - 120	14	.022 ± .005	.018 ± .003	.058 ± .018	.048 ± .009	.252 ± .051	0.358 ± 0.12
over 200	16	.015 ± .003	.014 ± .002	.069 ± .010	.045 ± .009	.323 ± .080	0.437 ± 0.14

* ± standard error of the mean.

and the volume adjusted to 2 ml with n-hexane. Five ul was injected into a gas chromatograph using conditions described by McCully and McKinley (6).

Arrangement of the residue data according to level of liver vitamin A is shown in Table I. Adipose tissue was not analyzed for organochlorine pesticides. DeVlieger et al (7) showed a compartmental model for the distribution of dieldrin and DDT-type materials between adipose tissue and liver for man and Radomski et al (8) also found a correlation in the general population between liver and fat concentrations of p,p'-DDT and its metabolites. On the other hand, they found virtually no correlation between the liver and fat concentrations for the pesticides measured in diseased subjects. It was considered that liver levels were more meaningful than levels in the adipose tissue if the pesticide induced changes in the liver to alter metabolism or storage of vitamin A. The pesticide residue profiles showing detectable amounts of heptachlor epoxide, dieldrin, p,p'-DDT, DDD and DDE were similar to those shown for human liver from other countries (7,8,9). Of prime importance are the observations that of the pesticides or metabolites measured in liver, no significant differences in concentration were found between the various levels of liver vitamin A. These data suggest that the level of ingestion and resulting body burdens of certain organochlorine pesticides do not contribute to the incidence of low vitamin A stores in Canadians.

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